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Using time to express remoteness in space:
A corpus-based study of distance representations for motion medium in the National Corpus of Polish

Abstract: Entanglement of space and time in the human mind is among the most intensely pursued topics in contemporary cognitive science. A linguistic area that seems to be particularly suited to researching this problem is the domain of motion events because in this context expressions of distance can take both spatial and temporal representations. This study demonstrates a proportion between spatial and temporal expressions of distance for the semantic attribute of motion medium based on objectively verifiable frequencies of language patterns found in the National Corpus of Polish. Data obtained in this research show that in this semantic context Polish speakers tend to render distance both in spatial and temporal terms, with spatial representations being used more frequently, but not by a large margin. The results indicate that in the framework of motion events space and time act as complementary to each other, which suggests that they are correlated metonymically, rather than being asymmetrically dependent.

Keywords: Space, time, spacetime, motion, events, medium, Ground, cognition, corpus linguistics

1. Introduction

Subjective distance in space, i.e. what people know or believe about a distance, depends on a number of factors, including the complexity of environmental features, the physical effort that needs to be expended, and the time required to reach a destination, especially in situations of restricted access to other kinds of information (Montello 2009; Tversky 2011). Observations of travel time as a popular metric of spatial distance, especially in the context of urban environments, have been made for years in studies on geographical cognition (MacEachren 1980; Montello 1997). Yet, according to widespread linguistic intuitions, it seems that the relationship between time and space in linguistic expressions of distance is dictated by the asymmetry of space and time reflected in conceptual metaphors (Lakoff & Johnson 1980, 1999). As put deftly by Casasanto, Fotakopoulou & Boroditsky, (2010):
In English, it is nearly impossible to talk about domains like time without using words that can also express spatial ideas: Vacations can be long or short, meetings can be moved forward or pushed back, deadlines can lie ahead of us or behind us. Yet it is far less common to use temporal words to talk about space (Lakoff & Johnson 1999). Although we could say that we live “a few minutes from the station,” we could just as easily express this spatial idea in spatial words, saying “a few blocks from the station.” (Casasanto et al. 2010: 388).

However, in linguistics some aspects of language are generally perceived, while others have to be computed to be evaluated properly. Intuitive judgments often lead to heuristics and biases (Kahneman 2011; A. Tversky & Kahneman 1974). As noted by the father of modern corpus linguistics, the late John Sinclair (1991: 4), “human intuition about language is highly specific, and not at all a good guide to what actually happens when the same people actually use the language”. Since access to statistics on the frequency of language patterns is unavailable through linguistic intuition, providing verifiable data on the frequency of language patterns in corpora is a key asset that the corpus methodology brings to linguistic studies.

In recent years, a number of scholars have voiced a need for cognitive linguistics to put a stronger emphasis on the application of empirical data derived from corpora (e.g. Geeraerts 2006; Grondelaers, Geeraerts & Speelman 2007; Heylen, Tummers & Geeraerts 2008). Since a commitment to the usage-based model of language is among the central theses of cognitive linguistics (Evans 2012; Janda 2015), making use of linguistic performance samples goes naturally with cognitive linguistic research. On these grounds, this paper examines a proportion between spatial and temporal representations of distance in the semantic context of motion events (Talmy 2000a, 2000b) from the perspective of data found in the National Corpus of Polish (henceforth, NCP). More specifically, this study is restricted to examining linguistic expressions of distance for the semantic attribute of motion medium, i.e. the environment in which motion occurs. It complements studies conducted earlier for the semantic attributes of instrument and manner (Waliński 2014a, 2014b), and parallels a study conducted for English (Waliński, in press) with the British National Corpus.

2. Conceptions of space–time relations

Entanglement of space and time in cognition is among the most intensely pursued problems in contemporary cognitive science (Núñez & Cooperrider 2013). The mutual relationship between mental representations of space and time can be viewed at least in four different ways. One originates from the empiricist philosophy, which assumes that the nature of all knowledge is affected by sensory experience (Markie 2015). Since space and time serve as our two basic locational
frameworks by means of which we situate objects and events, the perception of space is inextricably connected with the perception of time. As stated by Locke (1689/1995: 140), “expansion and duration do mutually embrace and comprehend each other; every part of space being in every part of duration, and every part of duration in every part of expansion”. From this perspective, it is difficult to think about either without thinking about the other, which makes these two domains symmetrically dependent on each other. Engberg-Pedersen (1999) assumes that space and time are so strongly interwoven in cognition, that they should not be analyzed as two separate domains. She argues that although it is possible to distinguish between conceptualizations of space and time at some cognitive levels, the distinction between space and time should be attributed to the difference between static objects and dynamic events, rather than space and time as such.

However, an alternative proposal posits that space and time are asymmetrically dependent. This view stems from an assumption that while the domain of space appears to be directly accessible through the senses, the domain of time escapes sensory perception. As put by Lakoff (1993: 218), “… we have detectors for motion and detectors for objects/locations. We do not have detectors for time”. Consequently, it is plausible to presume (e.g. Clark 1973; Lakoff & Johnson 1980, 1999) that space is the concrete domain that provides us with means of structuring time. As an outcome, time is processed indirectly and structured metaphorically in terms of space.

As a third possibility, the cognition of space and time can be considered independent of each other, despite being much alike due to a similarity between these two domains. For example, Jackendoff (2002; see also Jackendoff & Aaron 1991) suggests that, although our conceptions of space and time may be thematically parallel, which is reflected in spatial metaphors used for expressing temporal concepts, the presumed primacy of space is illusory. Jackendoff points out that it is epistemologically equally plausible to assume that space and time are essentially unrelated domains organized by a common set of parameters that are simply more transparent in the spatial than in the temporal verbalization. From this perspective, it is possible that metaphors referring to space and time arise out of the structural similarity (Murphy 1996) of pre-existing conceptual structures between space and time. Although spatial metaphors have become conventional ways of talking about time, they are actually unrevealing about the space–time relations (see also Pinker 2007, Ch. 5).

Moreover, space and time can be viewed from the perspective of the unitary framework of spacetime, which was geometrically modeled by Minkowski (1908/1964) with reference to Einstein’s (1905/1952a) Special Theory of Relativity.
Subsequently announced Einstein’s (1916/1952b) *General Theory of Relativity* assumes that we function in a four-dimensional universe determined by three-dimensional space combined integrally with the fourth dimension of time (Hawking 1988; see also DiSalle 2006, Ch. 4). The theory forces us to accept that time is not completely independent of space, but is combined with it to form an entity called spacetime. However, although the concept of spacetime has been considered in some linguistic studies (e.g. Bączkowska 2011; Jaszczolt 2009), it normally escapes human intuition. As emphasized by Hawking (1988: 10), most people, including scientists, still use Newton’s (1687/1995) model to think and talk about time and space in everyday situations. He adds that although it is sometimes helpful to think of the four spatial-temporal coordinates of an event in terms of space-time pictured mentally as a four-dimensional space, imagining a four-dimensional space is in fact impossible.

Langacker (2012: 200–203) emphasizes that the assumption that space and time form a four-dimensional representational space in conception of objects and events is a foregone conclusion. He adds that despite certain parallelisms suggesting that space and time are comparable, there exist important asymmetries indicating that time is not just another space-like cognitive dimension. For instance, although from the perspective of Einsteinian physics it would be as accurate to assume that motion through space occurs in time as that motion through time occurs in space, in everyday language we are inclined to say that a falling apple gets “closer and closer” rather than “later and later” to the ground. Relations between space and time have been discussed from various perspectives in abundant literature (e.g. DiSalle 2006; Evans 2013; Le Poidevin 2003; Moore 2014; Smart 1964; Tenbrink 2007 and references therein), yet the nature of this relationship has not been established precisely.

3. **(Dis)similarities between space and time in the human mind**

Comparisons between psychological space and time are difficult to conduct because sensory modalities involved in the perception of space have more clearly defined aspects than those involved in the perception of time (Grondin 2010). After almost 130 years of research, psychology has yet to distinguish a definitive sensory system responsible for perception and processing of time (Matthews & Meck 2014). Neuroscience has not found the neural basis for the processing of temporal intervals and the experience of duration, either (Wittmann 2013).

Historically, the perception of space was both intuitively and in empiricist philosophy associated with the visual modality. However, systematic studies in blind and sighted individuals have provided ample evidence that visual experience is not
a necessary feature in the mental development of spatial representations (Millar 2008). It appears that spatial knowledge depends on a cognitive structure that organizes information obtained through all modalities, but itself is not dependent on any particular modality (Spence & Driver 2004).

What makes investigations of the relationship between space and time in cognition even more difficult to conduct is that they are attributed different dimensionalities. Time is generally regarded as a linear vector extending ahead into the future and back into the past. On the other hand, space is discussed in terms of one-dimensional distances, two-dimensional planes, and three-dimensional spaces. Another basic difference between space and time is that the dimension in which time extends, or “flows” as we tend to say, is not reversible, which has been termed by Galton (2011) *temporal transience*: what occurs in time, occurs only once at that very moment, with no possibility of return (see Bergson 1922/2002 for a discussion on the evanescent nature of time).

On the other hand, there are certain similarities between space and time in cognition. Classic studies in psychophysics (Stevens 1986) have demonstrated that people associate lines of different lengths with tones of different durations, and vice versa. Both adults and children recognize them as meaningful representations and provide consistent and systematic responses to them in psychophysical tasks based on spontaneous alignment of representations of temporal duration with representations of spatial length (e.g. Casasanto et al. 2010; Srinivasan & Carey 2010).

Moreover, a link between spatial and temporal dimensions of psychological distance has been observed in their relation to the level of mental construal. An extensive series of studies on construal of distance (see Liberman & Trope 2014 for a review) found that events located further away in space and time are more likely to be represented in terms of abstract and general features at a higher level of mental construal. According to Construal-Level Theory of Psychological Distance, temporal and spatial distances are associated and are inferred from one another, which makes them act in the human mind in a complementary and compensatory way.

**4. Representations of motion-framed distance**

This study investigates what is called here *motion-framed distance* (cf. *motion-framed location* in Tutton 2012), which refers to a distance that separates one point from another in space in the semantic context of motion events. Talmy (2000b, Part 1) characterizes a basic *Motion event* as a situation consisting of four internal
core components: (1) the presence or absence of motion (Motion); (2) the moving entity (Figure); (3) the object with respect to which the Figure moves (Ground); (4) the course followed by the Figure with respect to the Ground (Path). In the context of this study it is worth pointing out that the component of Motion refers to “the presence per se of motion or locatedness in the event” (Talmy 2000b: 25), despite the fact that in the latter the Figure does not change its position with respect to the Ground. Moreover, Talmy distinguishes an associated co-event, which refers to (5) the manner in which the motion takes place (Manner); and (6) the cause of its occurrence (Cause). Levinson (2003: 96) notes that the description of motion involves an additional set of parameters that denote not only change of location, but also manner, instrument, medium of motion, as well as other attributes.

As already mentioned, this study is restricted to examining linguistic representations of distance for the semantic attribute of motion medium (cf. Ground in Talmy 2000b). However, it must be emphasized that the semantic attributes of motion are not easily disentangled. For instance, the expression by sea not only encodes the medium through which a traversal takes place, but additionally implies a certain manner of travelling, typically sailing, which in turn involves a range of instruments used for that purpose, e.g. a ship, boat, etc. (see Goddard and Wierzbicka 2009 for a study demonstrating how the semantics of physical activity verbs in English, Polish, and Japanese ties the kind of instruments used in the action with the manner in which the instrument is used). Therefore, at least for certain instances of distance expressions, it is impossible to make an absolute distinction between medium, manner, and instrument since they form a kind of semantic cline.

In order to verify empirically how frequently motion-framed distance representations marked semantically for the medium of motion are expressed in Polish with spatial vis-à-vis temporal terms, this study employs Narodowy Korpus Języka Polskiego (the National Corpus of Polish, henceforth NCP). It is a 240 million word collection of samples taken from both spoken and written contemporary Polish roughly mirroring the British National Corpus in its structure (see www.nkjp.pl for more information). The NCP has the important advantage of being a publicly available standard reference corpus, which enables other researchers to attest or expand the present research. The corpus was examined using queries based on regular expression syntax (see Waliński 2015 for a full listing accompanied by corresponding concordances retrieved from the NCP), which provides for immediate replicability of the study with nothing more than a web browser.

The examination was implemented by looking for frequencies of spatial and temporal adverbials that express absolute distance, i.e. one denoted using spatial or temporal units. Although the use of adverbials represents a fundamental way
of expressing remoteness in space, it is far from being exhaustive of the entirety of ways used for representing spatial distance in language (see Carlson 2010 for an overview). However, the aim of this paper is not to examine the full array of linguistic means available for denoting remoteness in space, but to observe a general proportion between spatial and temporal representations of the motion-framed distance for the semantic attribute of medium in Polish.

4.1 Language patterns

Medium of motion has been discussed in literature under a variety of different labels. Langacker (2008) subsumes it under the umbrella term landmark. Talmy (2000a, 2000b) sees it as Ground that acts as a spatial reference point for the motion/location of the Figure. Talmy (2000b) considers conflation of Motion + Ground in verbs roots as a minor pattern in linguistic representation of motion events, and notes that in English this semantic attribute is predominantly expressed with prepositional phrases. In Polish, it is typically expressed with prepositional phrases involving accusative nominal forms, e.g. “przez morze” [EN: over the sea_ACC.], “przez las” [EN: through the forest_ACC.] or locative nominal forms “po drodze” [EN: by road_LOC]. Alternatively, a similar sense of space traversed, although less bounded perhaps, can be conveyed by bare instrumental nominal forms, e.g. “morzem”, “lasem”, “drogą” [EN: sea_INS., forest_INS., road_INS.], etc. The following schematic patterns were used to search for these options in the NCP:

**SPATIAL or TEMPORAL UNIT + PREPOSITION + MEDIUM OF MOTION** [ACC or LOC]; [SLOP FACTOR=1, PRESERVE ORDER= YES]
**SPATIAL or TEMPORAL UNIT + MEDIUM OF MOTION** [INS]; [SLOP FACTOR=0, PRESERVE ORDER=YES]

The selection of motion media examined in this research involves ten environments typically involved in journeying: ląd, woda, powietrze, śnieg, bezdroże, góra, las, morze, droga, kolej [EN: land, water, air, snow, field, mountain, forest, sea, road, railway], also in plural forms where applicable, which parallels items analyzed previously for English (Waliński, in press). The selection of prepositions was limited to po and przez, whose meaning may be approximated (Lewandowska-Tomaszczyk 2012) by a range of English prepositions such as: across, along, by, over, through. This choice of nominal forms for landmarks and accompanying prepositions is obviously far from being exhaustive of Polish expressions of distance for the medium of motion, but appears to be reasonably adequate for the purpose of this study.
Since this study aims specifically to identify representations of the motion-framed distance denoted in terms of temporal duration, e.g. “Szedł ponad cztery godziny po sniegu” [EN: He walked over four hours through/over the snow] vis-à-vis ones denoted in terms of spatial expansion, e.g. “Przebyli przeszło tysiąc kilometrów morzem” [EN: They travelled over a thousand kilometers by sea], a unit of space/time measurement was incorporated in the patterns. Units of time measurement selected for analysis involve those that are typically used to express duration, i.e. minutes, hours, and days [PL: minuta, godzina, dzień]. Units of space measurement selected for comparison include meter, kilometer and mile [PL: metr, kilometr, mila]. Although Polish speakers do not normally express spatial extents with imperial units, the [nautical] mile (PL: mila [morska]) is used in the context of sea travels.

Because lexemes in the above schematic patterns do not always follow directly one after another in linguistic performance, searching was implemented with proximity queries (Bernard & Griffin 2009). Essentially, proximity queries afford us to take account of additional modifiers between query terms. They allow for specifying a slop factor, which determines how far apart lexical items included in a query can be from one another to be still returned as a result to the query. In this study, corpus queries were implemented with the slop value of 1, which reveals more specific environments, such as “boczne, kamieniste, żużlowe, oblodzone, puste, ruchliwe drogi” [EN: back, stony, cinder, icy, empty, busy roads], etc. For the nominal instrumental pattern the slop value was set to 0 to avoid an excess of coincidental hits. Additionally, the binary (yes/no) preserve order option was set to “yes” to indicate that the original order of query terms should be retained in results (see Waliński 2015 for a full listing of all queries used in this study).

5. Summary of results

Because the use of proximity queries increases the recall of results at the expense of their precision (see Pęzik 2011), the resulting set of concordances retrieved from the NCP had to be carefully reviewed to eliminate examples sharing the defined sequence/proximity of lexical items by coincidence.¹ Out of 239 concordance lines retrieved from the BNC, 128 were recognized as valid representations of the motion-framed distance in spatial or temporal terms, e.g. “Do kościoła jest pięć kilometrów przez las” [EN: The church is five kilometers through the forest] or “Asuan dzielą zaledwie trzy godziny jazdy koleją od prastarego Luksoru” [EN:

¹ For instance, “po drodze” is ambiguous between the sense discussed here and another, related meaning close to “on one’s way” or a more idiomatic (metaphoric) “by the way”.
Asuan is separated from ancient Luxor only three hours by railway, etc. The results found for the selected language patterns are presented in Table 1.

Table 1. Expressions of the motion-framed distance in spatial and temporal terms found in the NCP for the semantic attribute of motion medium.

<table>
<thead>
<tr>
<th>Medium of motion</th>
<th>Denoted in spatial terms</th>
<th>Denoted in temporal terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>ląd (land)</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>woda (water)</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>powietrze (air)</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>śnieg (snow)</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>bezdroże (field)</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>góra (mountain)</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>las (forest)</td>
<td>24</td>
<td>14</td>
</tr>
<tr>
<td>morze (sea)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>droga (road)</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>kolej (railway)</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>71</strong></td>
<td><strong>57</strong></td>
</tr>
<tr>
<td><strong>Proportion</strong></td>
<td><strong>55%</strong></td>
<td><strong>45%</strong></td>
</tr>
</tbody>
</table>

Although the number of examples retrieved from the NCP for the semantic attribute of medium is not very extensive, it can serve as an indicator of the relationship between space and time in motion-framed distance expressions. Table 1 shows that for the selected landmarks the number of spatial expressions 71 (55%) exceeds the number of temporal expressions 57 (45%). Still, the proportion between spatial and temporal expressions of the motion-framed distance for this semantic attribute appears to be balanced rather than totally dissimilar. It is noteworthy that a very similar ratio (56% vs. 44%) has been observed in a parallel study conducted earlier for English (Waliński, in press) with the British National Corpus, which indicates that the overall result does not arise haphazardly.

Although it is impossible to discuss language in terms of absolute numbers and ratios, the proportion of spatial vs. temporal expressions of motion-framed distance found in the NCP for the semantic attribute of motion medium confirms observations made earlier (Waliński 2014a, 2014b) that denoting spatial extents in temporal terms is a common way of expressing spatial distance in the semantic context of motion events. The results indicate that for the medium of motion...
Polish speakers tend to express the motion-framed distance both in spatial and temporal terms, with spatial representations being used more frequently, but not by a large margin. Since this tendency has been found to occur cross-linguistically, it appears to be modulated by the presence of the semantic element of motion, rather than by linguistic patterns alone.

6. Conclusions

It would be unwise to draw hard and fast conclusions about the relationship between space and time in the human mind from the results of research so restricted in its scope. However, it is plausible to presume that the obtained data are indicators of certain properties of the entanglement between space and time in cognition. Since the linguistic representation of space is largely relativistic and approximate, rather than Euclidean and quantitative (Talmy 2000a, Part 1), it comes naturally to language users to express spatial distance in temporal terms. This way of expressing distance is highly versatile. Because clocks and watches are much more widespread than instruments of distance measurement, it is a relatively straightforward way of expressing a distance that is unknown precisely in metric terms. Moreover, it allows for expressing a distance from the speaker’s subjective point of view as a particularly short/long way to a destination, e.g. “Wieki miną nim dotrzemy stąd do Warszawy!” [EN: It will take ages to get to Warsaw!]. For very remote or hard to access places, we specify the distance to Mars in months of space traveling or the distance to Mt. Everest peak in days of climbing without even noticing the shift from spatial to temporal domain of representation. Denoting spatial distance in terms of travel time is particularly convenient in urban environments, where reaching various destinations depends not as much on the spatial separation as on the traffic intensity at different times of the day.

More specifically, the results demonstrate that in the semantic context of motion events space and time often act in a complementary fashion, rather than being universally asymmetrically dependent. This complementarity can be observed more directly in certain instances of language use found through a concordance analysis, e.g. “Odległość od Warszawy – 18 kilometrów, 28 minut koleją” [EN: The distance from Warsaw – 18 kilometers, 28 minutes by railway] or “Odwiedzilam Kadyny – kilometr od Zalewu Wiślanego, pół godziny drogi od Elbląga” [EN: I visited Kadyny – located one kilometer away from the Vistula Lagoon and half an hour away from Elbląg]. Such examples demonstrate that spatial and temporal representations can act on an equal footing in expressions of remoteness in space, which indicates that in the context of motion events space and time are closely tied and neither can be regarded as the metaphorical extension of the other.
Moreover, B. Tversky (2011) emphasizes that knowledge of space on the horizontal plane is derived from motion in time. Since each and every motion occurs in space and takes time, space and time are interchangeable and intertwined in numerous senses in spatial cognition. Kövecses (2005: 53; see also Lakoff & Johnson 1999: 152) notes that in English one can say, “I slept for fifty miles while she drove” (Distance For Time-Duration) and “San Francisco is half an hour from Berkeley” (Time-Duration For Distance). He argues that in such expressions time and motion act as correlated domains joined in a single literal conceptual frame of Time-Motion schema, within which elements can stand for each other in the form of metonymies. Engberg-Pedersen (1999) points out that we can use names of places, which are primarily spatial words, to denote punctual moments in time in terms of spatial locations, e.g. “I haven’t had a drink since London”.

In the light of this study, it is plausible to propose that in the semantic context of motion events both time and space can be viewed as elements of a unified conceptual frame of Space-Time-Motion, which dictates the relationship between space and time in a complementary fashion. Within this schema any two elements can stand metonymically for the third one: time elapsed in motion can be used to express spatial distance; space traversed in motion can be used to identify duration, which is commonly used for telling the time by the Sun’s position in the sky; a punctual moment in time can be used to specify a location passed while traveling; and a specific location passed during traveling can be used to refer to a specific moment in time. This cognitive complementarity of space and time in motion representations is likely to be related to the unity of time, space, and motion pointed out by Aristotle (350BC/1995), or perhaps even to the spatial–temporal relativity assumed by Einstein’s (1916/1952a) General Theory of Relativity.

References


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